

# **Minnesota's Approach to Nutrient Criteria Development: Brief update on lake & river criteria**

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## **Background & Overview**

1. Present draft lake criteria
2. Overview of our approach
3. Application of criteria – from TMDLs to protection;
4. Rulemaking timeline & summary
5. Status of river nutrient criteria development;
6. Summary

Minnesota's Draft Eutrophication Criteria. Summer-mean concentrations should be below these levels to maintain "use."

Ecoregion	TP	Chl-a	Secchi
(classification)	ppb	ppb	meters
NLF – Lake trout (Class 2A)	12	3	4.8
NLF – Stream trout (Class 2A)	20	6	2.5
NLF – Aquatic Rec. Use (Class 2B)	30	9	2.0
CHF – Stream trout (Class 2a)	20	6	2.5
CHF – Aquatic Rec. Use (Class 2b)	40	14	1.4
CHF – Aquatic Rec. Use (Class 2b) Shallow lakes	60	20	1.0
WCP & NGP – Aquatic Rec. Use (Class 2B)	65	22	0.9
WCP & NGP – Aquatic Rec. Use (Class 2b) Shallow lakes	90	30	0.7

## Definitions (include in rule)

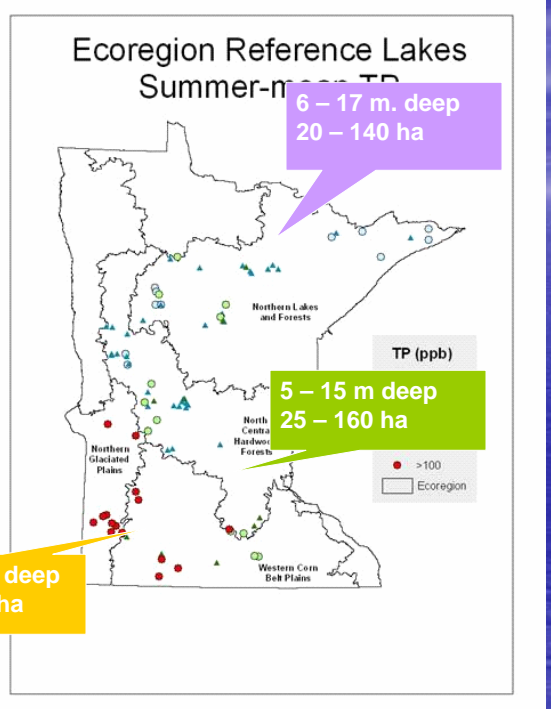
- Need to differentiate among lakes (shallow vs. deep), reservoirs, wetlands & rivers
- "Lake" – enclosed basin...max. depth > 15 ft. (4.5m) -- 10 acres (4 ha) minimum size for "lakes";
- "Shallow lake" - max. depth 15 ft. (4.5 m) or less or 80% or more littoral (drawn from Schupp); generally not wetlands;
- "Reservoir" – natural or artificial basin where outlet is controlled by control structure. Differentiated from rivers based on Tw of 14 days or more as determined based on a summer "120 day Q10";
- Index period – summer (June – September);

## Minnesota's Ecoregions & Reference Lakes:

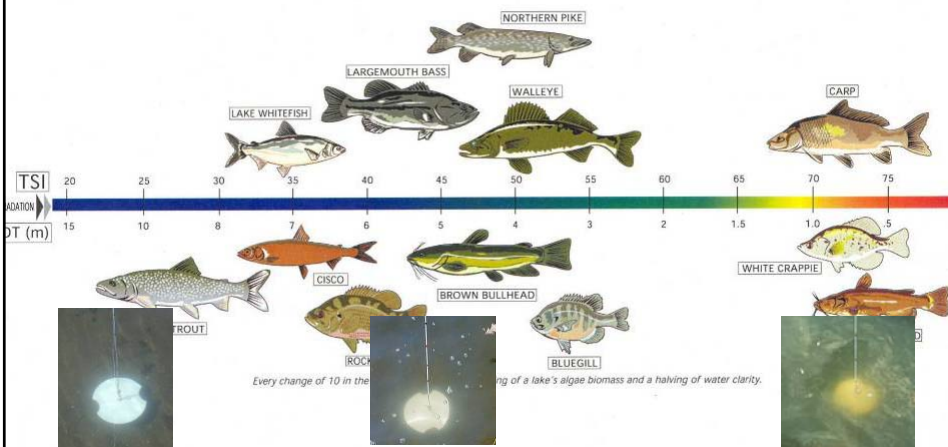
98% of MN lakes located in these 4 ecoregions;

Reference lake monitoring began in 1985 - ~ 90 "minimally-impacted, representative lakes

WQ & morphometry varies among regions;

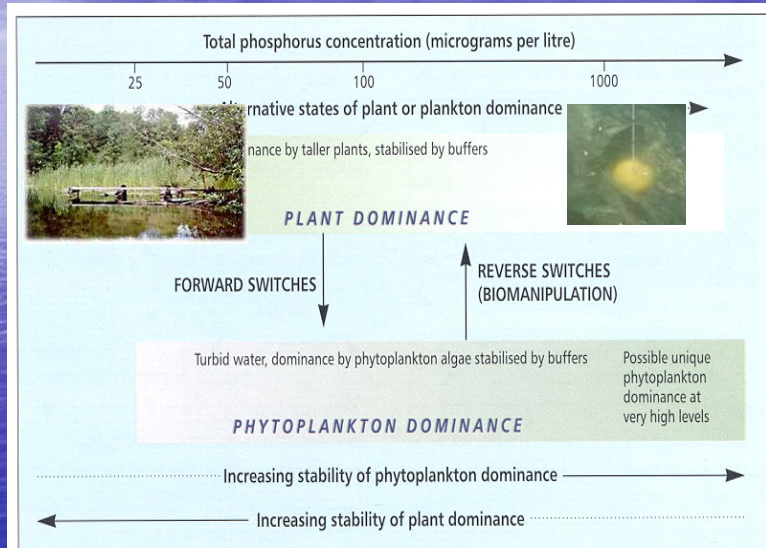


Fish species vary relative to lake trophic status (Carlson's TSI)  
MPCA criteria range from ~12 ug/L (40) to 90 ug/L (70)

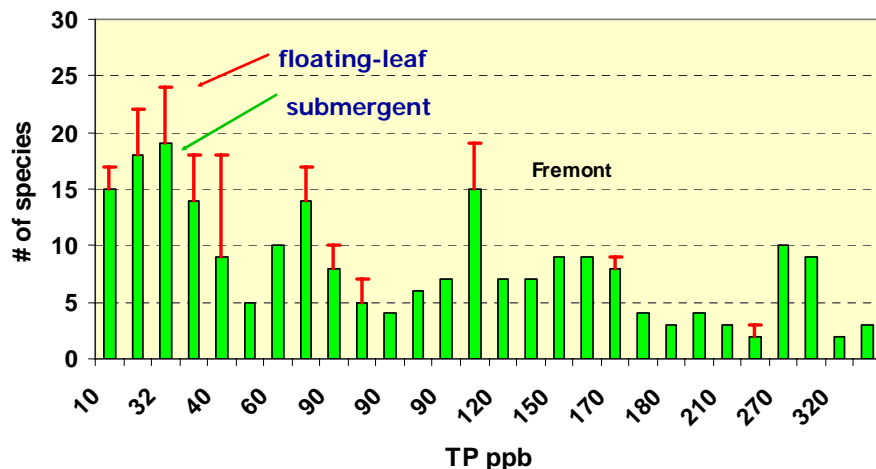


Based on work of Dennis Schupp & paper by Schupp & Wilson 1993

Worked to identify thresholds for shallow lakes. Collaborated with MDNR in study of 27 shallow lakes in west-central MN. Examined rooted plant data & metrics relative to WQ data.

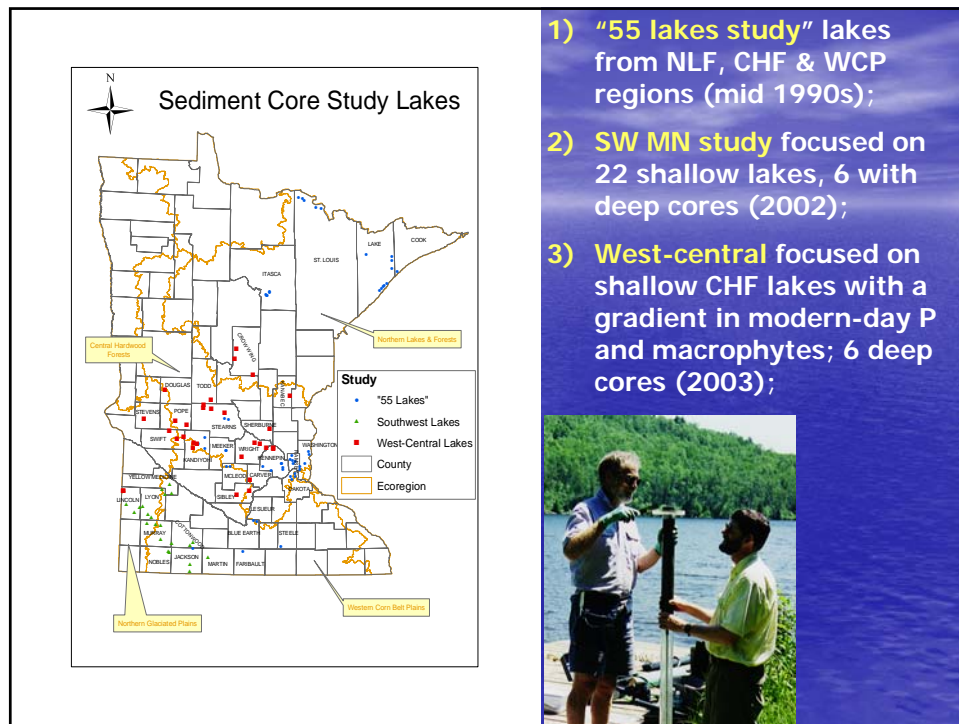


**West Central Shallow Lakes:**  
# of submergent & floating-leaf species.



Based on 27 lakes - as TP increases above ~60-90 ppb, floating-leaf generally absent & 10 or fewer species present





## Main Features & Approach

Draft criteria (TP, chl<sub>a</sub>, & Secchi) based on weight-of-evidence approach that considers:

- Regional patterns in lake morphometry, water quality, & watershed characteristics.
- Within-ecoregion distributions of TP, chl-a & Secchi - reference & overall populations;
- Varying uses of lakes & differences among deep & shallow lakes;
- Consider fishery (aquatic life) requirements;
- Shallow lakes – emphasis on plant communities relative to P, chl-a, & Secchi;
- Use of sediment cores to re-affirm regional patterns & estimate background;
- Accounts for lake user perceptions;

## Rulemaking timeline for Lake Criteria

- Public hearings in September, 2007
- Close of hearing record in October
- ALJ report in November – supports MPCA position on standards package.
- Approved by Citizen's Board in Dec.
- Approved by Governor's office Feb.;
- Rules public noticed – March;
- Await formal final approval by EPA
- Anticipate completion by summer 2008 & criteria formally adopted into WQ standards

## Summary

- Promulgation of standards almost complete -- finalize in 2008;
- Rules for 303(d)listing of nutrient-impaired lakes (2002) – used interim thresholds – standards will now be used;
- Standards language reinforces need to protect high quality lakes (non-degradation) and account for naturally poor quality lakes;
- Differentiate among shallow & deep lakes;
- Allows for site-specific criteria for reservoirs & other cases where deemed necessary (have guidance);
- Considers aquatic life requirements & should be beneficial to fisheries management.

## Water quality rules & lake assessment pages

MPCA Home

Water -- Regulations

Proposed Water Quality Standards Rule  
Revision

<http://www.pca.state.mn.us/water/standards/rulechange.html>

Water -- Lakes -- Lake Water Quality Assessment  
Report: Developing Nutrient Criteria

<http://www.pca.state.mn.us/water/lakequality.html#reports>

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## River Nutrient Criteria Development. Minnesota's status report for 2008

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2008 Update



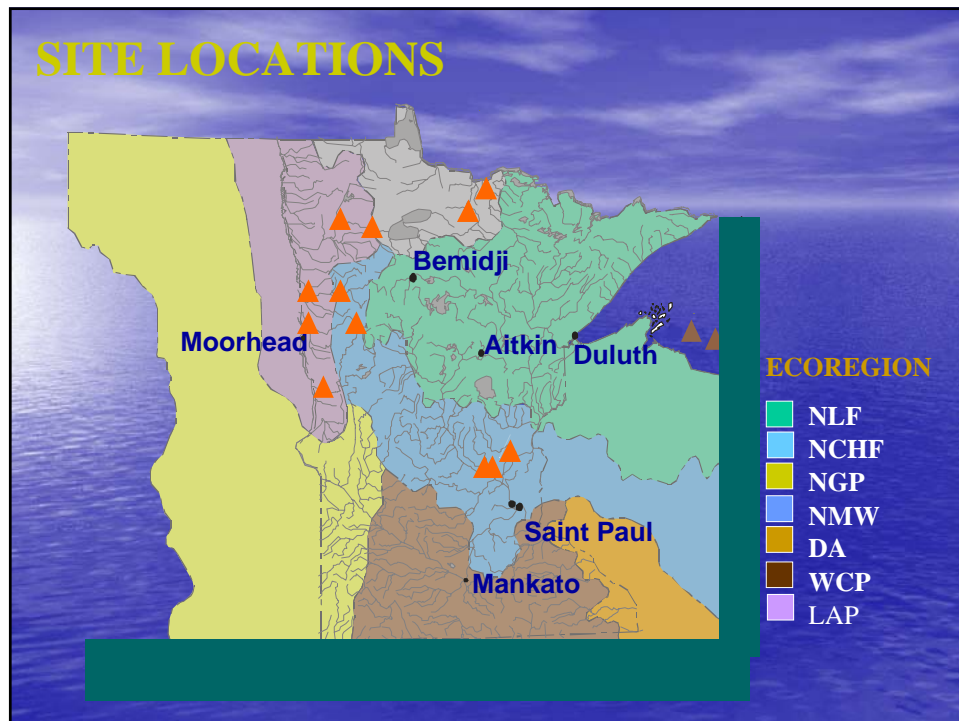
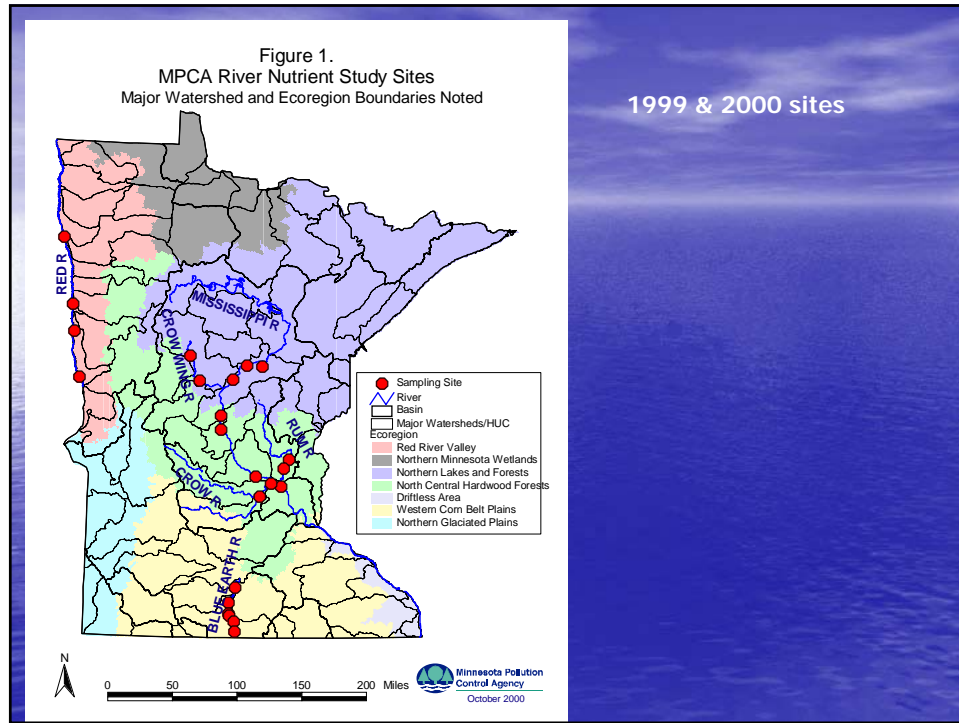
## Objectives and Purpose

- Research supports national nutrient criteria efforts for rivers (work supported in part by EPA nutrient criteria grant);
- Document a systematic understanding of relationships among nutrient concentrations, algae, BOD, and fish and inverts. in medium to large rivers; and
- Provide a basis for setting ecoregion-based nutrient criteria by identifying thresholds for nutrient impairment

## Methods & Design: 1999 & 2000

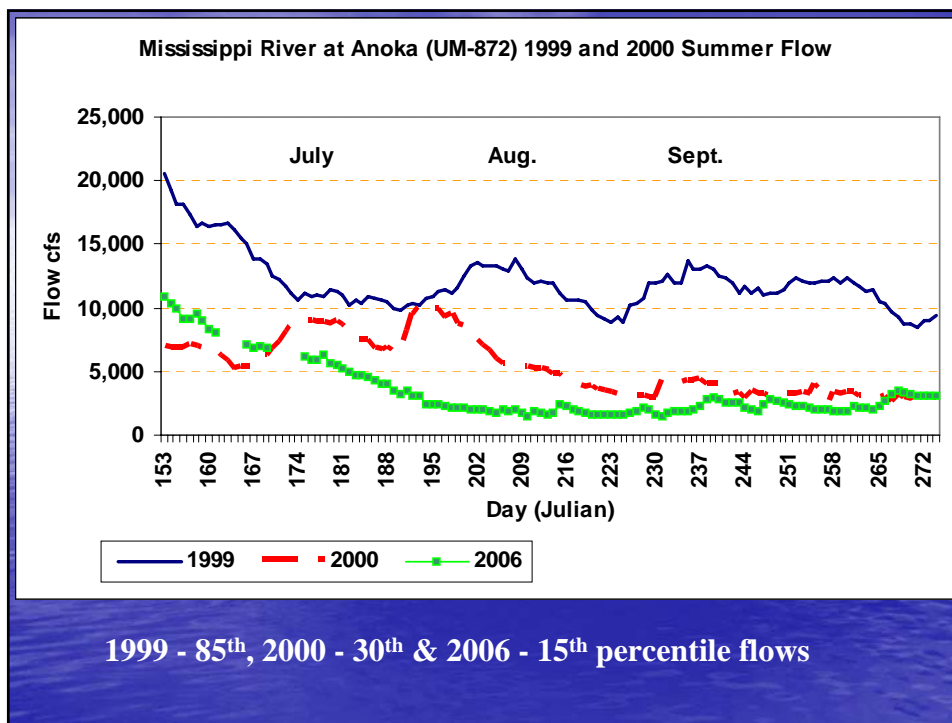
- Selected a range medium-large rivers characteristic of 3 of MN's ecoregions (watershed ~2,700 - 44,000 km<sup>2</sup>) 4<sup>th</sup> – 6<sup>th</sup> order generally;
- Include at least 2 sites per river (allow upstream/downstream comparison);
- No significant reservoirs between sites;
- At least one USGS gauge per river;
- Sample 5 - 7 times over summer -- "index period" ('99 & '00), additional sites in 2001 & 2006;
- nutrients, chl-a, TSS, TSV, turb., T-tube, phytoplankton identification





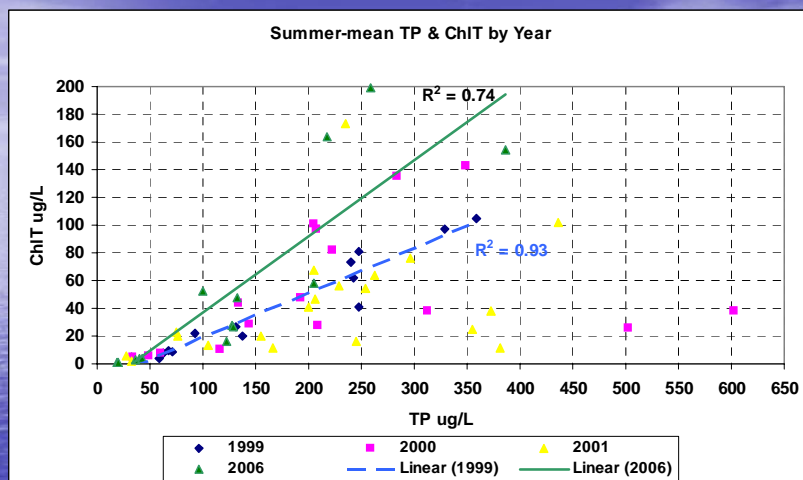
# 2006-2007 study additions

- 4 Red River tribs
- 2 NLF/NMW tribs
- Repeat Miss. @ Anoka, Rum & Crow River sites;
- Instrumented 12 sites total for up to 2 weeks;
- Invertebrate & fish data at most sites;
- Water quality data all sites 5-7 times

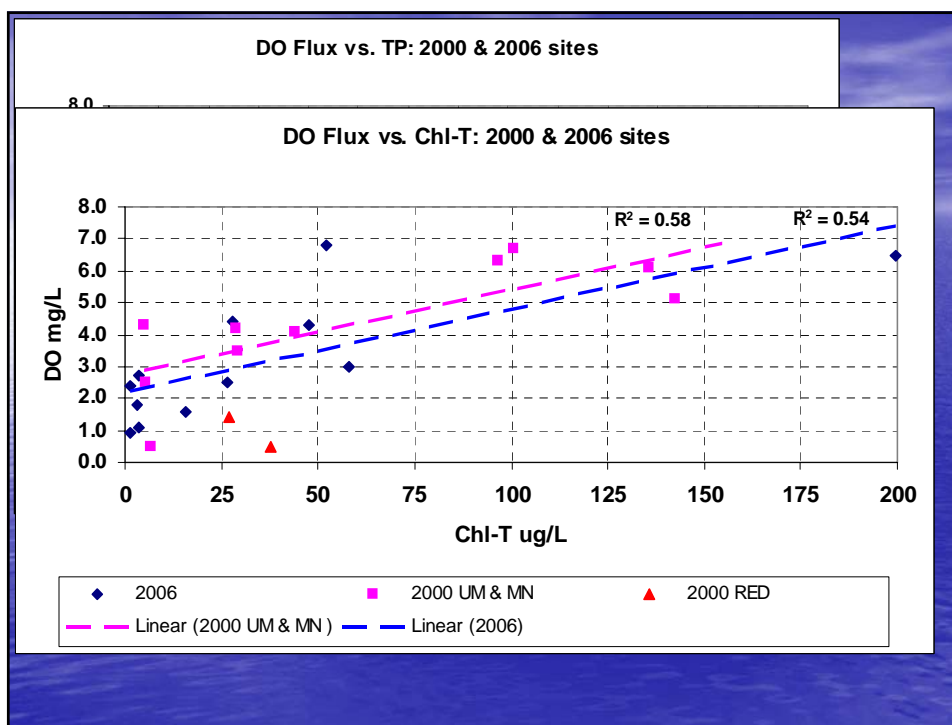
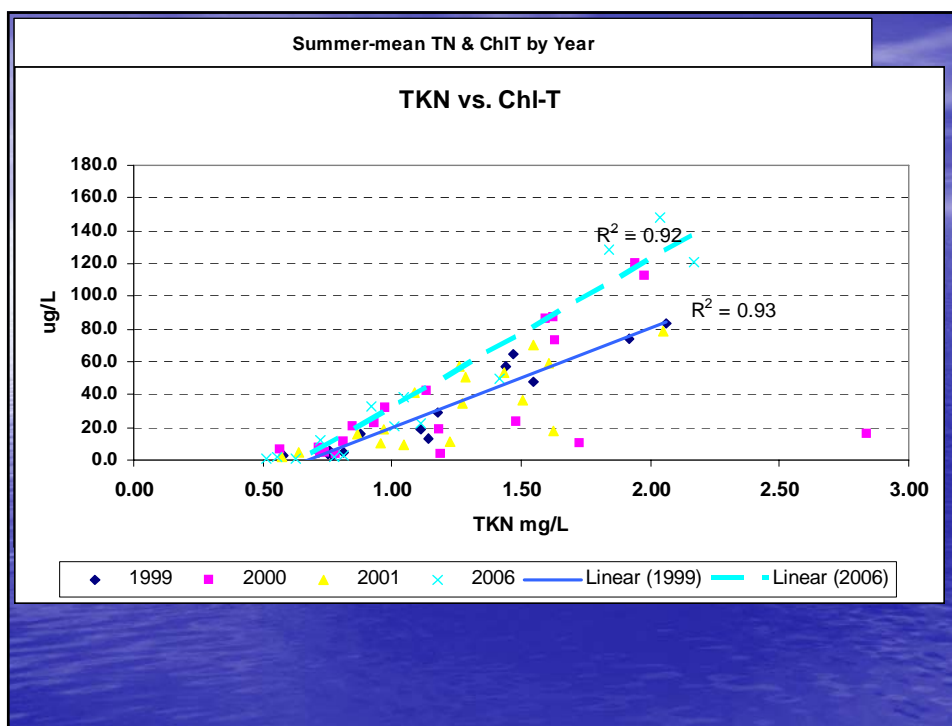


# Preliminary analysis of WQ from 1999, 2000, 2001 & 2006 and Comparisons of biota & WQ for 2000 & 2006 data

- Algal concentrations vary as function of nutrients, flow & light (within & among);
- However fairly consistent patterns in WQ relationships among years;
- Variability often function of selected sites and to some degree flow;
- Some distinct patterns among fish & invertebrate metrics relative to nutrient, Chl-T & DO flux
- Observed relationships and thresholds can contribute to nutrient criteria development

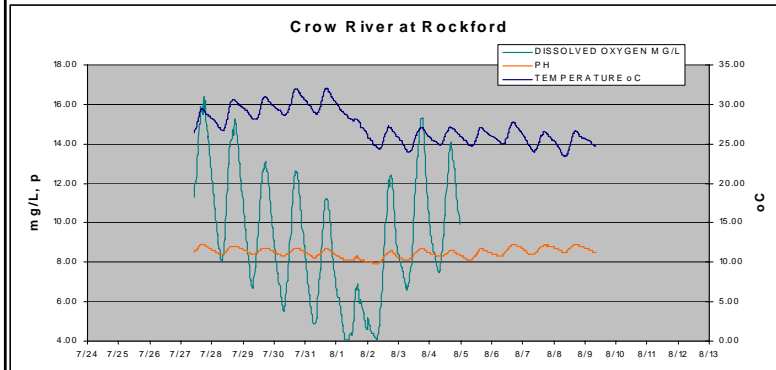






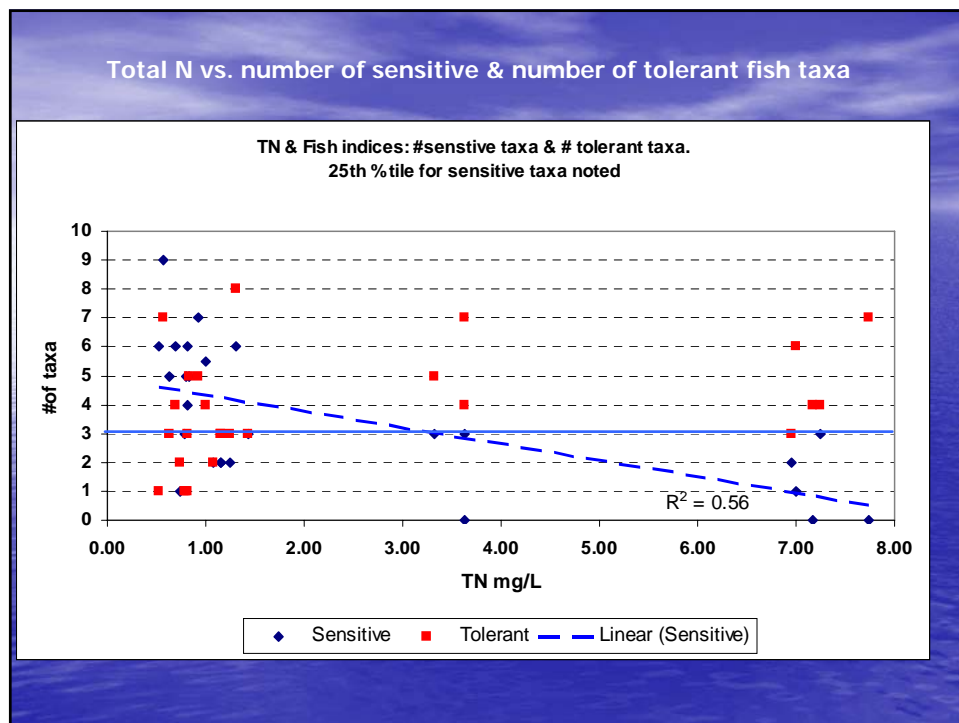
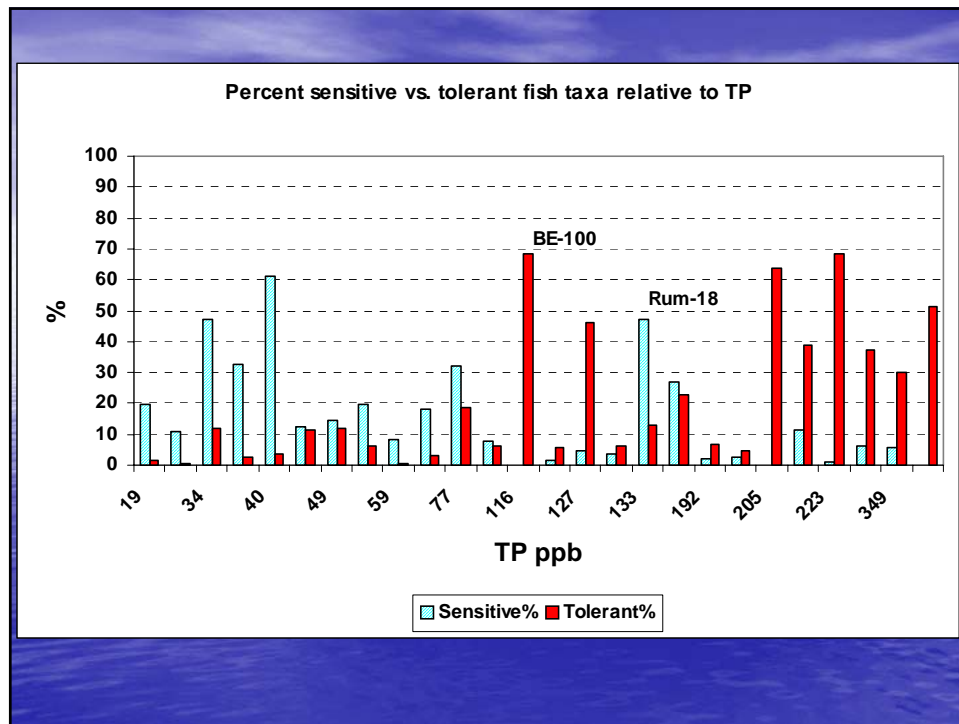
## Diurnal DO measurement & data analysis

**Figure 3. Variability in dissolved oxygen, pH, and temperature at the Crow River at Rockford, July 27 through August 9, 2006.**

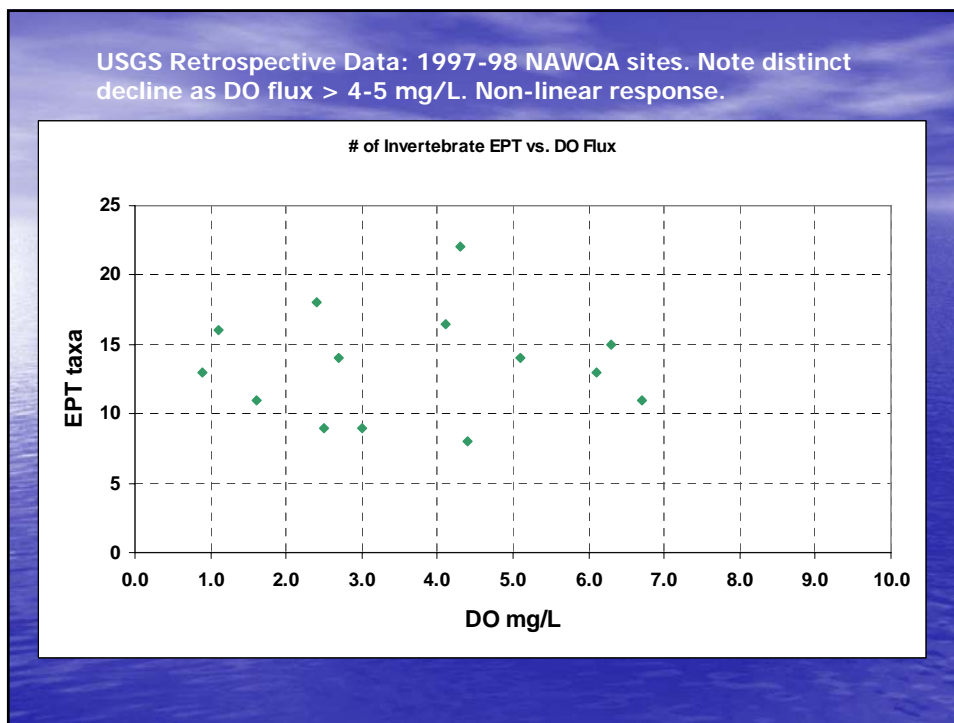
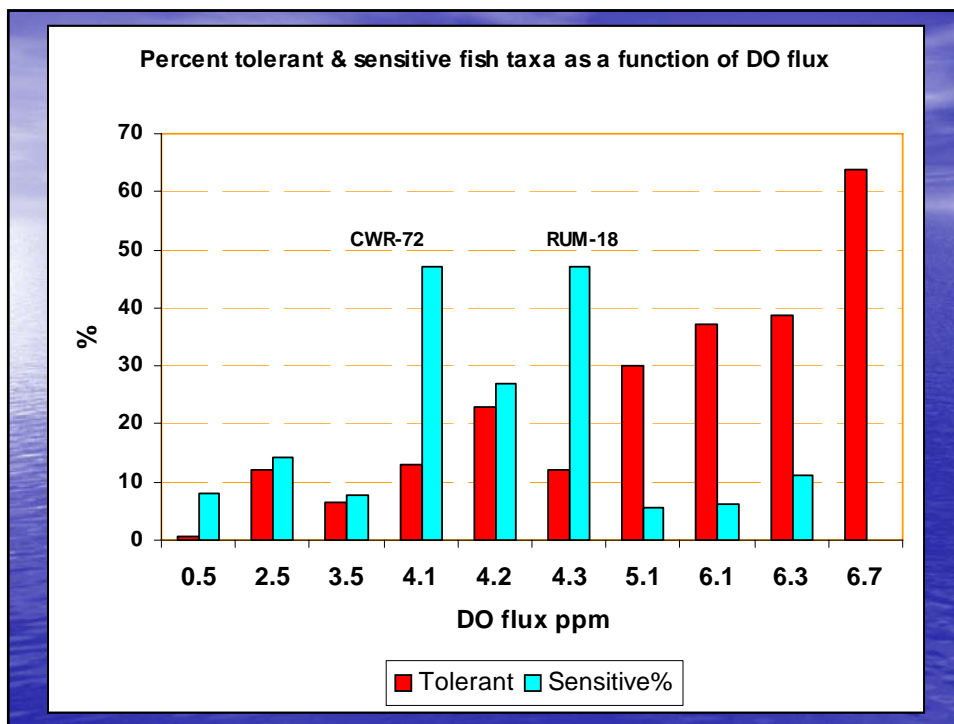


## Integrating fish & invertebrate data into analysis

- Fish and invertebrate data were gathered at several sites in 1999, 2000, 2005 & 2006 (independent but related work);
- These data are combined with respective WQ and diurnal data for those years for analysis;







## What's ahead?

- Complete data analysis from 1999, 2000, & 2006 including all WQ, DO flux, fish and invertebrate data;
- Build in USGS data from previous studies;
- Define relationships among nutrients and these variables;
- Integrate information from literature search;
- Begin to define thresholds for establishing nutrient criteria 2008-2009;
- Looking to promulgate river nutrient standards in next triennial review: 2008-2010